Arab influence, from the beginning of the tenth to the latter part of the twelfth century; and three centuries of the Scholastics form the last division. The salient characteristics of each division and the leading figures are clearly brought out. Specially notable is the lively picture of the travelling scholar from the West who gets in touch with Arab learning through some Jewish interpreter in a back street of Toledo; and on the side of theory due emphasis is laid on the cardinal doctrine of medieval science, the correlation of the macrocosm and the microcosm, and the enforcement of this by Arabian astrology.

The whole essay is valuable and deserves careful study. The original scientific work of Albertus Magnus receives full credit, though Stadler's new text of one work, the "De Animalibus," was still inaccessible when the book was published. There is an excellent short summary of Roger Bacon's achievements, and Nicolas of Cusa (1401–64) is recorded as the first biological experimenter of modern times, Helmont's experiment on a growing plant, showing that it absorbs something of weight from the air, being due to him.

If we must record a difference from Dr. Singer, it is one of emphasis rather than one of opinion or of fact. He appears to us to exaggerate somewhat the breach with the classical past which the new thought at the end of the medieval period involves. The difference is due mainly to the fact that as a biologist he is struck more by the mass of new and accurate observation which the modern biologist introduced, and less by the continuity of abstract reasoning which mathematical and astronomical science inherited from the Greeks.

Plantation Rubber Research.

Plantation Rubber and the Testing of Rubber. By Dr. G. Stafford Whitby. (Monographs on Industrial Chemistry.) Pp. xvi+559+8 plates. (London: Longmans, Green, and Co., 1920.) 28*s*. net.

THE general editor of this well-known series refers in his introduction to the extraordinary development which the applications of chemistry have experienced during the last four or five decades. In the case of the rubber industry the development is even more recent. Practically the whole of the facts dealt with in Prof. Whitby's book have been discovered within the last fifteen years, and with few exceptions the application of a knowledge of the chemistry of rubber to the industry may also be said to date from the introduction of plantation rubber. Previous to 1905 publications dealing with rubber were few and far between. With one outstanding exception, namely, C. O. Weber's "Chemistry of India Rubber" (1902), there was no text-book dealing with the subject from a theoretical or scientific point of view. The student at that time could make himself familiar with practically all that was either known or surmised by a study of Weber's treatise, and although many of the ingenious suggestions put forward by Weber have had to be abandoned, the book is one that can still be read with profit.

With the inception and development of plantation rubber several chemists began to take an interest in the study of this material, and from time to time other text-books have appeared. Whereas Weber was able to cover the whole field, including manufacturing technique and chemical analysis, in three hundred pages, many later authors have restricted themselves to special branches of the subject. Prof. Whitby has done this, and although he has dealt neither with manufacturing technique nor with analysis, his book runs to some five hundred pages. The title, if cumbersome, is certainly descriptive of the contents, and the book falls naturally into two parts, the first dealing with the preparation and properties of plantation rubber and the second with the physical properties of vulcanised rubber and the interpretation of results obtained in terms of "quality." The first section presents an exact and up-to-date account of the facts and theories underlying the preparation of plantation rubber and a description of the technique as at present in vogue on the best plantations in the East. Such a task could be attempted only by one who has actually carried out experimental work on a plantation and controlled the preparation of rubber. Prof. Whitby had unique opportunities for observation and research, and he has made the most of them. Coming home after some years in the East, he has been able to follow up his plantation work with laboratory studies particularly directed to vulcanisation problems and their elucidation. Consequently the second part of the book presents as thorough and complete a review of the subject as the first.

In the early days of plantation rubber the planter naturally looked to the rubber manufacturer at home for information and advice as to the best form in which to market his product. But the majority of manufacturers did little beyond pointing out that "fine hard Para" was the best rubber, and should form the ideal of the planter's aims. The tedious and primitive process of the Amazon, however, was not suited to plantation requirements; so, having tested vari-

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ous coagulants and found acetic acid the most suitable, the planting industry eventually settled down to the production of rubber of two types: (1) washed coagulum, air-dried in the form commonly known as pale crêpe; and (2) surface-washed sheet rubber dried in a smoke-house, the so-called smoked sheet. Faced with these alternatives, the manufacturers were still unwilling or possibly unable to give the planter advice. Some could use only sheet, others only crêpe, yet from both varieties very good motor tyres were made and exhibited at the last rubber exhibition in 1914. Any lack of information or advice from the manufacturers was amply compensated for by the brokers and dealers. These gentlemen supplied abundant criticisms of surface defects and other minor details which have kept planters busy in their factories and the local chemists in their laboratories.

In spite, however, of the time thus occupied, a very considerable amount of scientific work dealing with vulcanisation and the chemical and physical properties of rubber has been accomplished. Prof. Whitby's book is a significant record of the research work carried out on behalf of the planting community. With one or two exceptions, our whole knowledge of the subjects treated rests on the results of such researches. The remainder of the book is concerned with the more purely physical researches on the properties of vulcanised rubber, for which we are indebted to the academic physicists. This is a novel feature, and comprises the first summary of the subject to be published.

The technical aspect of rubber vulcanisation is dealt with by the author in chap. 16. This is perhaps the one chapter in the book which might with advantage have been extended. It is true that our knowledge in this direction is very limited, for reasons already given, but the subject-matter does not include references to some of the more recently published work. It might with advantage have included an account of work on organic and inorganic "accelerators," or vulcanisation catalysts, and cognate subjects, with particular reference to the fast-curing types of plantation rubber in which the "natural accelerators" take the place of the synthetic products which would otherwise have been added by the manufacturer. In this chapter, and indeed throughout the book, the author has succeeded in preserving a detached and impartial attitude when commenting on published results. He has examined each thesis with care, and expressed his reasoned conclusions with moderation.

The book contains a mass of information—in fact, practically everything of importance that is known on the subject—and while it is put together systematically, it is no mere catalogue of facts and theories. One occasionally meets with an awkwardly worded sentence, but the meaning is usually clear. A few instances taken at random may be quoted. The word "breaking length" appears to be used in the sense of final length, whereas in other industries the expression has a totally different meaning. Hollow mixing rollers are usually provided with a single inlet or outlet, which serves for either steam or water; they are not provided internally with separate pipes for each. The "thickness" of a ring referred to on p. 288 is more correctly described as the width, for if the ring is considered as a short tube, the thickness would correspond to the thickness of the wall of the tube.

The author has dealt with a subject which is in a state of rapid development, and considerable skill must have been required to incorporate the new material appearing during compilation. This may account in part for the frequency of footnotes of considerable length, some of which might with advantage have been included in the text. We have noticed a few inaccuracies and misprints; for instance, "clippings," "modal," "centrifiguating," "Euphoria," and "laticometer." The book is provided throughout with copious references and an excellent bibliography which will be found of great value.

H. P. S.

Aeronautics.

(1) *Aviation: Theoretico-Practical Text-book for Students.* By B. M. Carmina. Pp. ix + 172. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1919.) 11*s.* net.

(2) *The Theory and Practice of Aeroplane Design.* By S. T. G. Andrews and S. F. Benson. (The Directly-Useful Technical Series.) Pp. xii + 454. (London: Chapman and Hall, Ltd., 1920.) 15*s.* 6*d.* net.

(3) *Aeroplane Structures.* By A. J. S. Pippard and Capt. J. L. Pritchard. With an introduction by L. Bairstow. Pp. xiii + 359 + 21 plates. (London: Longmans, Green, and Co., 1919.) 21*s.* net.

(1) THERE is certainly room for a good elementary treatise on the aeroplane, written for young students who have only a moderate equipment of mathematical knowledge, and whose acquaintance with mechanics is limited to the fundamental principles and their immediate applications. Mr. Carmina had an obvious gap to fill, but one must unhesitatingly declare that he has failed to take advantage of the opportunity.

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